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(71) Applicant: **Maschinenfabrik Rieter AG**
8406 Winterthur (CH)

(72) Inventors:
- **MORAVEC, Milan**
  56201 Ústí nad Orlicí, Hylváty (CZ)
- **BROZEK, Tomas**
  56201 Ústí nad Orlicí (CZ)

(54) **A YARN BALLOON LIMITER AT A SPINNING UNIT OF A RING SPINNING MACHINE, A RING SPINNING MACHINE, A METHOD OF THREADING YARN INTO THE BALLOON LIMITER OF YARN AND A METHOD OF HANDLING A COP**

(57) The invention relates to a yarn balloon limiter (4) at a spinning unit of a ring spinning machine, comprising a holder (41); a pair of pins (46, 47) mounted in the holder (41), wherein the longitudinal axes of the pins (46, 47) are parallel to each other; two half rings (50, 51) arranged opposite each other to form a ring in closed position, wherein each of the half rings (50, 51) is connected to one of the pins (46, 47), the pins (46, 47) being coupled to a drive of their rotation. Both pins (46, 47) are mounted horizontally with respect to the rotation of their longitudinal axes. The invention also relates to a ring spinning machine, a method of threading yarn into a balloon limiter (4) and a method of handling a cop (10) by means of an automatic service robot.

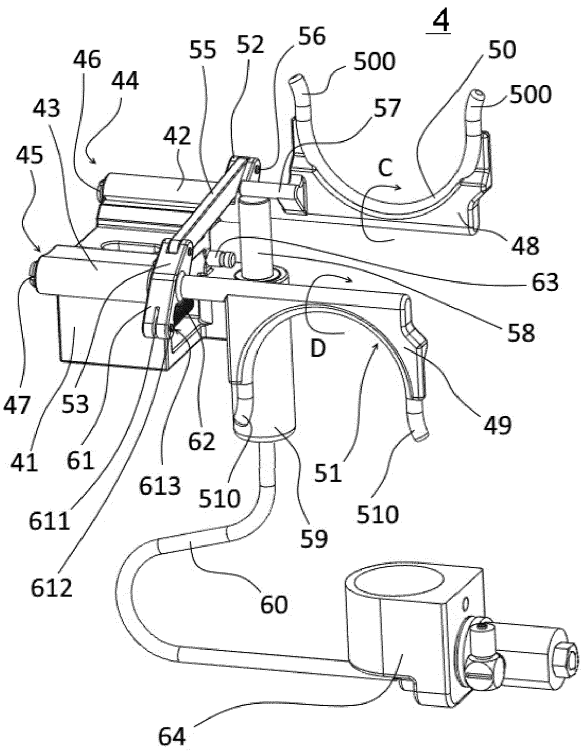

Fig. 2a

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Description

Field of the invention

[0001] The invention relates to a balloon limiter at a spinning unit of a ring spinning machine comprising a holder, a pair of pins mounted in the holder, the longitudinal axes of the pins being parallel to each other, two half rings arranged opposite each other to form a ring in a closed position, whereby each of the half rings is connected to one of the pins and the pins are coupled to a drive of their rotation.

[0002] The invention also relates to a ring spinning machine comprising a row of spinning units arranged next to each other, wherein each spinning unit comprises a roving drafting device, a roving guide and a yarn twisting and winding device, whereby at each spinning unit a yarn balloon limiter is arranged in the area between the roving guide and the yarn twisting and winding device.

[0003] In addition, the invention relates to a method of threading yarn into the balloon limiter at a spinning unit of a ring spinning machine in the area between the roving guide and the yarn twisting and winding device, which includes a step of guiding a yarn end through a working means of a service robot from a cop back to the roving drafting device, during which a step of threading yarn into the balloon limiter is performed.

Description of related art

[0004] Ring spinning machines comprise a row of spinning units arranged next to each other, each of which comprises a roving drafting device. From the drafting device the processed roving of fibers is fed by a roving guide and a balloon limiter further to a twisting device, from which the produced yarn is withdrawn and is subsequently wound with the aid of a traveller, which circulates around a bobbin on a ring on a ring bench, in a winding device on a tube which is placed on a rotatable spindle. Winding yarn on a tube results in a cop formation.

[0005] During the operation of a spinning unit and during yarn production, the process of yarn production can be interrupted, e.g. owing to a yarn break, which also causes a traveller to stop moving on a ring on a ring bench and, as a result, a yarn end is wound on a cop package. Consequently, the yarn is also pulled from a yarn guide, from a balloon limiter and from the traveller. After such interruption of yarn production, it is necessary to renew the yarn production at the spinning unit in question by a series of service operations performed manually or by service means. In doing so, it is necessary to find the yarn end on the cop package, unwind it form the cop package, and thread it first into the traveller on the ring, next into the balloon limiter and then the yarn guide and finally bring the yarn end between the end rollers of a roving drafting device so that during the spinning resumption the yarn end can be connected to the roving end and the process of the yarn production and winding yarn is resumed. Once the cop has been fully wound, the spinning is also stopped, the fully wound cop being replaced either with an empty tube or with a tube with pre-wound spinning-in yarn. Subsequently, the so-called auxiliary yarn is used to resume the spinning process or it is the end of yarn pre-wound on a newly inserted tube that is used to renew spinning. Afterwards, this yarn is again inserted into the individual nodes at the spinning unit of the machine and spinning is resumed.

[0006] Current ring spinning machines are predominantly operated manually, mainly due to the relative complexity of the operations performed when threading yarn into the individual nodes at the spinning unit. Substitution of these activities by a service robot is, in principle, possible but poses high demands on service mechanisms and the time required to carry out these activities. For example, some current mechanisms at the spinning unit require a complex spatial threading motion, which puts limitations on the usage of the automated means.

[0007] In present-day ring spinning machines, a balloon limiter at the spinning unit is formed as a rule by a steel wire having a circular cross-section, which is shaped into a circle forming an unclosed ring, whereby one half of the circumference of the ring is situated in a horizontal plane and the other opposite half of the ring is inclined at a small angle from the horizontal plane downwards and passes below the end portion of the first half of the ring with a slight spacing vertically, so as to leave between the cylindrical surfaces of both ends of the ring a space - a gap - for the passage of the yarn when being threaded into the balloon limiter. The ends of the annular section are joined substantially tangentially by the straight end portions of the balloon limiter, which are terminated with a bend extending from the center of the limiting ring towards its outer side so as to facilitate the guidance of the threading yarn into the threading gap. The circular end portions of this ring of the balloon limiter overlap each other in the plan view, so that the ring appears in the plan view as closed. In the middle of its circumference, the balloon limiter ring is attached - welded - by its outer circumference to a holder that is detachably mounted on the ring bench. Thus, the operator or the service robot must carry out a several motions with the yarn being inserted, following one another, which is both time consuming and difficult in terms of the space. Recently, there has been an ever-increasing pressure put by the users of the ring spinning machines on the use of automatic service robots. However, it is required that the automatic operations at the spinning unit are performed in the shortest possible time with the highest possible reliability and without conflict with machine parts. Therefore, it is necessary to adapt not only the service robot itself but also some parts or nodes of the spinning unit. One of these nodes, which can be adjusted to improve the feasibility of automatic service operations at the spinning unit, is also the balloon limiter.

[0008] DE 1 049 747 B discloses a balloon limiter at a spinning unit of a ring spinning machine, whose ring con-

sists of two separate half rings arranged opposite each other, which in the operating position of the balloon limiter lie in a common plane. Each half ring is mounted at the end of a pin which is tangential to the respective ring and which lies in the plane of the half rings. The two pins are parallel to each other and are mounted rotatably about their longitudinal axes in a holder, which is mounted tiltably about the axis perpendicular to the longitudinal axes of the two pins of the half rings on a bracket, which is adapted to attach the entire assembly to the frame of the machine. The rotatable pins of the half rings are at their free ends bent perpendicularly to the longitudinal axis of each of the two pins, namely bent towards the adjacent pin, whereby each of these bent ends is associated with one control cam, which is mounted on the bracket adapted to attach the entire assembly to the frame of the machine. When lifting, or, to put it more specifically. when tilting upwards, the holder on the bracket pushes the control cams to the bent ends of the pins of both the half rings. As a result, the two pins rotate about their longitudinal axes and the two half rings rotate simultaneously with them in a mirror-symmetric manner downwards. This will cause the balloon limiter to open automatically when the holder is lifted. When the holder is tilted down into the operating position of the balloon limiter, the half rings turn back to their initial, i.e. operating, position of the balloon limiter due to the action of a tension spring, which is stretched between the transverse protrusions on the two pins of the half rings. The inner diameter of the balloon limiter ring is smaller than the largest outer diameter of the yarn package on the tube and at the same time it is larger than the largest outer diameter of the tube. The balloon limiter thus arranged, vertically divided, allows a reduction in the diameter of the circle that the yarn balloon circulates around the spindle during spinning, thereby reducing the likelihood of the yarn breaking between the drafting device and the traveller moving on the ring. This solution also facilitates the removal of the wound cop from the spindle. However, the disadvantage of this arrangement is that when tilting the holder and simultaneously rotating the two halves of the ring, it is necessary for the operator of the machine to exert increased force to overcome the passive resistances of the rotating pins of the half rings and of the tiltable holder and to overcome the force action of the half rings. All this, together with the necessity to perform a greater number of motions during the manual service, causes prolonged service time and makes the service operations more demanding. Another disadvantage is the fact that in this solution there is friction between a number of metal parts, which causes their increased wear and is reflected in the unreliability of the whole device and its shorter life.

Brief summary of the invention

[0009] The aim of the invention is therefore to eliminate or at least reduce the drawbacks of the background art, especially to allow easy and reliable threading of yarn into the divided tiltable yarn balloon limiter at a spinning unit of a ring spinning machine and ensure long-term reliability of the balloon limiter.

[0010] The goal of the invention is achieved by a balloon limiter at a spinning unit of a ring spinning machine, comprising

- a holder;
- a pair of pins mounted horizontally in the holder, wherein longitudinal axes of the pins are parallel to each other;
- a half ring connected to each of the pins;
- wherein the two half rings arranged opposite each other to form a ring in closed position; and
- wherein the pins are coupled to a rotational drive to pivote around the longitudinal axes in order to open and close the ring formed by the two half rings.

[0011] Preferably, each of the half rings is provided with extended end portions and in the closed position, the extended portions of the first half ring overlap the extended end portions of the second half ring.

[0012] Preferably, one of the half rings is mounted so that it rotates upwards and the other half ring is mounted so that it rotates downwards.

[0013] Preferably in a first embodiment of the invention, between the holder and the half rings on each of the pins is arranged a transverse control arm, wherein both the control arms are coupled to each other by a connecting rod, one of the rotatable pins being provided with a transverse stop lever, against which rests the protruding element of the rotational drive.

[0014] Preferably in the first embodiment of the invention, a retractable piston rod of a pneumatic cylinder leans against the transverse stop lever, the pneumatic cylinder being connected to the holder to activate and close and open the balloon limiter.

[0015] Preferably in the first embodiment of the invention, one of the rotatable pins is provided with a second transverse arm, which is connected to the first control arm and is situated opposite the control arm, the free end of the second transverse arm being coupled to the holder by a tension spring.

[0016] Preferably in a second embodiment of the invention, a control arm is mounted at the front end of one of the rotatable pins, whereby this pin is further provided with a transverse control arm, which is by the first connecting rod coupled to the first end of a two-arm lever, which is arranged transversely on a shaft, which is mounted on the holder rotatably about its longitudinal axis, which is parallel to the longitudinal axes of the rotatable pins, whereby the two-arm lever is by its other arm and the rod coupled to the transverse control arm of the other of the pair of pins.

[0017] Preferably in the second embodiment of the invention, on the holder is arranged a positioning spring leaf, which is associated with a collar on the shaft with the two-arm lever, wherein the collar is provided with a

pair of positioning surfaces turned with respect to each other, on which the leaf spring abuts in the working or threading position of the half rings.

[0018] Preferably in a third embodiment of the invention, the rotatable pins are at their rear ends bent first towards each other and then in the opposite direction, being shaped like the letter "U", whereby the bent end portions of the two pins pass transversely through the longitudinal horizontal groove, which is situated parallel to the plane passing through the longitudinal axes of the two Preferably, rotatable pins and which is arranged in the vertically sliding arm, which is reversibly slidably mounted in the holder and which is coupled to a vertical reversible slidable drive.

[0019] Preferably in the third embodiment of the invention, the vertical reversible slidable drive comprises a vertically situated bowden, which is by one of its ends mounted on the rigid part of the holder and by its other end is adapted to be mounted on the rigid part of a holder of a tiltable yarn guide, whereby a cable wire or string passes through the bowden, the cable wire being connected by one of its ends to the vertically sliding arm and the longitudinal groove and by its other end being adapted to be connected to the vertically movable part of the tiltable yarn guide.

[0020] Preferably in the third embodiment of the invention, both the half rings are mounted in such a manner that they can rotate up or down.

[0021] Preferably, the half rings are formed by bent steel sheet or by a body made of technical ceramics.

[0022] Preferably, the half rings are provided with an abrasion-resistant surface finish.

[0023] Preferably, the half rings are mounted on the pins detachably.

[0024] Preferably, holders are mounted on the pins, in which the half rings are mounted detachably.

[0025] Preferably, the holders are formed by molding plastic parts or plastic splatter, or they are made of a fiber composite or metal, or a combination of at least two materials.

[0026] Preferably, one of the pins is coupled to one end of a flexible shaft, whose other end is arranged at a spinning unit of the ring spinning machine and is adapted to be optionally connected to an external drive.

[0027] The goal of the invention is as well achieved by a ring spinning machine comprising a row of spinning units arranged next to each other, wherein each spinning unit has a drafting device, a roving guide and a yarn twisting and winding device, whereby at each spinning unit in the region between the roving guide and the yarn twisting and winding device is arranged the yarn balloon limiter according to any of claims 1 to 16.

[0028] The goal of the invention is as well achieved by a method of threading yarn into the yarn balloon limiter during the resumption of yarn production or when replacing a cop at a spinning unit of a ring spinning machine, in which the yarn end is handled in such a manner that it is guided successively into the working nodes of the spinning unit from the cop to the roving drafting device and during this handling operation the yarn is threaded into the balloon limiter, in which before threading the yarn, the balloon limiter opens due to the turning of the half rings about the horizontal axis from its original horizontal to the vertical position, the yarn is guided to the space defined by the half rings; and the half rings turn about the horizontal axis from the vertical position back to the horizontal position, thereby closing the balloon limiter.

[0029] The goal of the invention is as well achieved by a method of handling a cop moving to/out of the balloon limiter during the resumption of yarn production at a spinning unit of a ring spinning machine or during the replacement of the cop, in which the cop is handled by being removed from or put on the spindle of the spinning unit below the roving drafting device and during this manipulation the cop is handled in the space of the balloon limiter, in which before the manipulation the balloon limiter (4) opens by turning the half rings about the horizontal axis from the originally horizontal position to vertical position, the cop is removed/inserted through the space defined by the half rings, and the half rings turn about the horizontal axis from the vertical position back to the horizontal position and the balloon limiter closes.

[0030] The advantage of this solution is fast and reliable threading of the yarn into the balloon limiter during spinning resumption or during the start-up of spinning, which contributes to reducing the time needed for the service operations of the spinning unit and increases the efficiency of the machine. Moreover, this solution enables to handle the tube and remove it from the spindle of the machine also in machines with a drafting device located upstream and thereby limited space in the vertical direction. Another advantage is simple and reliable construction of the limiter, which allows both automatic and manual control.

Brief description of the drawings

[0031] The invention is schematically represented in the drawing, wherein it is shown by

Fig. 1 an arrangement of an embodiment of a spinning unit;

Figs. 2a, b the first exemplary embodiment of a yarn balloon limiter;

Figs. 3a, b the second exemplary embodiment of the yarn balloon limiter; and

Figs. 4a, b the third exemplary embodiment of the balloon limiter.

Detailed Description of the invention

[0032] The invention will be described with reference to exemplary embodiments of a yarn balloon limiter at a

spinning unit of a ring spinning machine producing yarn, an example of embodiment of a ring spinning machine producing yarn and exemplary embodiments of methods of operation of the balloon limiter and its applications.

[0033] A ring spinning machine comprises a row of identical spinning units arranged next to each other. On principle, the arrangement of a spinning unit of a ring spinning machine is well-known and therefore it will only be described hereinafter in a simplified manner for the purposes of this invention. Those parts, elements or nodes of the spinning unit that are of significance to the present invention will be described in greater detail.

[0034] The spinning unit of a ring spinning machine is schematically represented in Fig. 1 and comprises an unillustrated supply package, from which a roving 0 is fed in the direction of the arrow A to a roving drafting device 1. A yarn twisting and winding device 2 is arranged downstream of the roving drafting device in the direction of the running roving 0. Between the roving drafting device 1 and the yarn twisting and winding device 2, where the roving is gradually transformed into yarn, the roving 0 first passes through a roving guide 3 and then through a balloon limiter 4 to reach a traveller 5, which circulates on a flange 6 of a ring 7 on a ring bench 8 around a rotating tube 9. After the passage through the traveller 5, the yarn is wound on the tube 9, which is placed on a rotating spindle (not shown), thus forming a cop 10. The yarn package on the tube 9 is formed by a continuous reversible vertical motion of the ring bench 8 in the direction of the arrow B.

[0035] The yarn balloon limiter 4, which is the subject of the present invention, is shown in greater detail in the example of embodiment in Figs. 2a, 2b. The yarn balloon limiter 4 comprises a static holder 41, which, in the embodiment shown, is formed as a hollow profile of a rectangular cross-section adapted to be attached to the spinning unit, for example, by means of bolts, eccentric connections, pins, etc., by which the holder 41 is attached, e.g., to the upper surface of the ring bench 8. The holder 41 is provided on the sides with protrusions 42 a 43, in the illustrated example arranged at the top of its rectangular cross-section in the opposite corners, in which are formed longitudinal fastening and guiding openings 44 and 45, in which rotatable pins 46 and 47 are mounted rotatably about the longitudinal axes of these openings 44 and 45 and thus also rotatably about their longitudinal axes. Arranged at the front ends of the rotatable pins 46, 47 are holders 48, 49 of limiting half rings 50, 51. Between the rear ends of the pins 46, 47, rotatably mounted in the holder 41, and the holders 48, 49 of the half rings 50, 51 is on each of the pins 46 arranged a transverse control arm 52, 53, both the control arms 52, 53 being situated in a matching direction and being coupled to each other at their free ends by a pin-joint 56 to a connecting rod 55.

[0036] One of the pair of holders 48, 49 of the half ring 50, 51, or one of the rotatable pins 46 and 47 is further provided with a transverse stop lever 57, against which rests the end portion of a retractable piston rod 58 of a pneumatic cylinder 59, which is mounted on the holder 41 of the balloon limiter 4 and which is connectable to a compressed air source, for example, it is connected by a hose 60 to a connection member 64 of the compressed air, which is located in a suitable position at the spinning unit, such as on the frame of the machine in the region of the mounting of a spindle driving the cop, etc. The connection member 64 is provided with an inlet opening of the compressed air, to which is connected, for example, an unillustrated valve of the compressed air source on the service robot, which is displaceable along the row of spinning units and which performs service operations at the spinning unit, including threading the yarn end into the ring of the yarn limiter 4.

[0037] One of the pair of the holders 48, 49 of the half ring 50, 51, or one of the rotatable pins 46 and 47 is provided with a second transverse arm 61, which is situated opposite the control arm 52, 53 and whose free end is by a tension spring 62 coupled to the holder 41 by a pin 63. In the shown embodiment, the free end of the second transverse arm 61 is by a continuous groove 611 divided into branches, shaped like a fork, through which passes a transverse pin 612 in a through hole 613 and on the transverse pin 612 a clamping eye is threaded at one end of the tension spring 62.

[0038] The holders 48 and 49 of the half rings 50, 51 are made of a suitable material, e.g. are formed by a molding plastic part or plastic splatter, or they are made of a fiber composite, such as carbon composite, or aluminium or a combination of at least two materials, etc.

[0039] One half ring 50, 51 is mounted in each holder 48 and 49, the half rings 50, 51 having the shape of a semi-circle with radially elongated, possibly even slightly bent, free ends 500, 510, by which the half rings 50, 51 in the closed position of the balloon limiter 4 overlap each other, i.e., these ends are arranged vertically above each other and the inner circumference of the semicircular portions of the half rings 50, 51 forms a closed circle in the plan view, since the half rings 50, 51 are situated with their inner radii facing each other. The half rings 50, 51 themselves are also made of a suitable material, especially abrasion-resistant. They are, for instance, made of bent steel wire or technical ceramics, etc., whereby they are attached to the holders 48 and 49 e.g. by clip couplings, or by gluing to the respective bearing shaped surfaces in the holders 48, 49, or they are fixed in the holder 48 and 49 by using spray techniques during the production of the holders 48 and 49, etc.

[0040] Threading the yarn into the balloon limiter 4 according to the embodiment in Figs. 2a and 2b for the resumption of spinning after yarn breakage is carried out in connection with other service operations performed by the service robot after it has arrived at the respective spinning unit. First, the rotating spindle with the cop 10 is stopped and the end of the broken yarn is detected on the cop 10 package, whereby the cop 10 is either ejected from the spindle or it remains on the spindle while the yarn end is being searched for. If the cop 10 is ejected

from the spindle, then the balloon limiter opens in advance and the open space is used for removing the cop 10. The description of the opening of the balloon limiter 4 is detailed below. After detecting the end of the broken yarn, the yarn end is passed to an unillustrated threading mechanism, the cop 10 is put back onto the spindle (if it has been removed from the spindle), and by means of a threading device it is threaded into the traveller 5. If the balloon limiter has not opened in advance for handling the cop 10, a compressed air source located on the service robot is connected to an inlet opening of the compressed air in the connecting member 64 and the compressed air is fed by a hose 60 to a pneumatic cylinder 59. As a result, a piston rod 58 is ejected, acting on the stop lever 57 in the direction of the arrow C, which results in the turning of the holder 48 by the half ring 50 about the longitudinal axis of the rotatable pin 46 into substantially vertical position shown in Fig. 2a. Due to the action of the connecting rod 55, the holder 49 simultaneously with the half ring 51 turns about the longitudinal axis of the rotatable pin 47 in the direction of the arrow D into substantially vertical position shown in Fig. 2a. It is apparent that one of the holders 48, 49 turns by the free ends 500, 510 of its half ring 50, 51 upwards, while the other turns by the free ends 500, 510 of its half ring 50, 51 downwards. When the holders 48 and 49 turn, the tension spring 62 is tightened at the same time. By turning the holders 48 and 49, a free space is created on the front - servicing - side of the cop 10 for the threading device with the yarn end passing from the traveller 5, continuing along the cop 10 through the space between the half rings 50, 51, which are now tilted up/down and ending above the balloon limiter 4. It is already at this stage that the air supply to the pneumatic cylinder 59 can be disconnected, whereupon the tension spring 62 turns the holders 48, 49 back, whereby the piston rod 58 of the half ring 50 and 51 is retracted and returns to its operating position shown in Fig. 2b, in which they surround the yarn, which is thus threaded into the balloon limiter 4. Subsequently, the yarn is threaded into the guide 3 above the balloon limiter 4 and the yarn end is guided between the unillustrated end rollers of the roving drafting device 1 so that during spinning resumption the yarn end is joined to the roving end and then the spinning-in process is started, changing into yarn spinning.

[0041] In the exemplary embodiment in Figs. 3a and 3b there is a balloon limiter 4 with a mechanical control mechanism, which comprises a control lever 70 mounted at the front end of one of the holders 48, 49, whereby on the rotatable pin 46 or 47 of this holder 48 or 49 is arranged a transverse control arm 53, whose end is by the first connecting rod 550 coupled to the first arm 751 of a two-arm lever 75 mounted on a shaft 740, which is mounted in a fixing and guiding housing 74 rotatably about its longitudinal axis, which is parallel to the longitudinal axes of the rotatable pins 46, 47 of the holders 48, 49. The two-arm lever 75 is by its second arm 752, which is situated opposite the first arm 751 coupled to a rod 77 with a transverse control arm 52 of the other of the pair of holders 48, 49. On the static holder 41 is further arranged a leaf spring 86, which is aligned with a collar 78 on the shaft 740, whereby the collar 78 is provided with a pair of turned (e.g. by 90°) positioning surfaces 84, on which abuts the positioning leaf spring 86, which in this manner secures the holders 48 and 49 with the half rings 50, 51 in their operating position, i.e. in closed state, or in their threading position, i.e. in open position.

[0042] The operation of threading the yarn into the balloon limiter 4 itself according to the embodiment of Figs. 3a and 3b is performed in such a manner that after, before or during the yarn threading by the threading device into the traveller 5, to a control lever 70 is connected a service means of motion (a linear or rotary pneumatic cylinder, a linear or rotary electromagnet or an electric motor, etc.), located on the service robot, which turns the control lever 70, by which means the holder 49 with the half ring 51 is turned in the direction of the arrow D from its operating position shown in Fig. 3b into the threading position (open position) shown in Fig. 3a. The motion of the holder 49 is transmitted over the arm 53 via the rod 73 to the first arm 751 of the two-arm lever 75 on the shaft 740, the blocking force of the leaf spring 86 acting on the positioning surface 84 on the collar 78 is overcome and the turning of the holder 49 is transmitted over the second arm 752 of the two-arm lever 75 via the rod 77 to the transverse control arm 52 of the other of the pair of holders 48, 49, thereby turning this holder 48, or 49 together with the half ring 50 in the direction of the arrow C from its operating position shown in Fig. 3b to the threading position (to the open position) shown in Fig. 3a, in which the holders 48 and 49 are held by a holding force formed by the abutment of the leaf spring 86 against the second positioning surface 84 on the collar 78. Therefore, both in the operating and in the threading position, the holder 48 and 49 is held by the pressure of the leaf spring 86 exerted on the positioning surface 84 on the collar 78, the positioning surface 84 being turned against the surface of a positioning leaf spring 86. A further process of threading the yarn into the balloon limiter 4, the roving guide 3 and feeding the yarn between the end rollers of the roving drafting device 1 proceeds as in the embodiment of Figs 2a and 2b. The holder 48 and 49 with the half rings 50 and 51 is returned to its operating position by the service means located on the service robot. In another embodiment, the turning of the control lever 70 is carried out manually by the machine operator.

[0043] In the embodiment in Figs. 4 and 4b, the yarn balloon limiter 4 comprises a static holder 41, which is adapted to be attached to the spinning unit, for example, by means of bolts, eccentric connections, pins, etc., by which the holder 41 is attached, e.g., to the upper surface of an unillustrated ring bench. The holder 41 is on sides provided with protrusions 42 and 43, in which are formed longitudinal fastening and guiding openings, in which rotatable pins 46 and 47 are mounted rotatably about their longitudinal axes. The rotatable pins 46, 47 are at their

front ends provided with half rings 50, 51 arranged opposite each other, the half rings 50, 51 having extended end portions 500, 510, which overlap each other in the closed position of the limiter 4, see Fig. 4a. The rear ends 460, 470 of the rotatable pins 46, 47 are bent towards each other and then in the opposite direction, which means that the rear ends 460, 470 are shaped like the letter "U". The bent end portions 4600, 4700 of both pins 46, 47 transversely pass through a longitudinal (horizontal) groove 90, which is situated parallel to the plane passing through the longitudinal axes of the two rotatable pins 46, 47. The longitudinal groove 90 is arranged in a vertically sliding arm 9, which is mounted vertically reversibly slidably in the holder 41, e.g. in a vertical groove 410. The vertically sliding arm 9 is coupled to a reversible vertical slidable drive 91, which in the embodiment shown comprises a vertically situated bowden 910, which is by one of its ends mounted on the rigid part of the holder 41 and by its other end it is mounted on the rigid part of the holder 30 of the tiltable yarn guide 3. A cable wire 911 passes through the bowden 910, the cable wire 911 being by one of its ends connected to the vertically sliding arm 9 with the longitudinal groove 90 and by its other end being connected to the vertically movable part of the tiltable yarn guide 3, e.g. to the rear end 31 of the tiltable yarn guide 3. In this embodiment, the opening and closing of the balloon limiter 4 is controlled by lifting and tilting down the tiltable yarn guide 3, in which the vertically movable part of the tiltable yarn guide 3, moves in the direction of the arrow S, which causes the movement of the control cable wire 911, which is transmitted as tension or pressure onto the vertically sliding arm 9 with the longitudinal groove 90. Consequently, the vertically sliding arm 9 moves upwards or downwards, this motion being transmitted, via the longitudinal groove 90 to the bent end portions 4600, 4700 of the two pins 46, 47, which, as a result, move linearly in the longitudinal groove 90 towards each other or away from each other, which results in the turning of the two pins 46, 47 in the holder 41 of the balloon limiter 4, and so the half rings 50, 51, arranged opposite each other, with the extended end portions 500, 510, tilt away from each other or towards each other, thereby opening or closing the balloon limiter, as can be seen from the comparison of the figures 4a and 4b. The yarn threading operation into the balloon limiter 4 according to the embodiment in Figs. 3a and 3b is performed, with the exception of controlling the opening and closing of the balloon limiter 4, similarly to the embodiment of Figs. 2 to 3b, whereby in the embodiment of Figs. 4a and 4b, the lifting and tilting down of the tiltable yarn guide 3 is performed by the service robot and with the aid of a means adapted for this operation or it is performed manually by the machine operator.

[0044] In an unillustrated example of embodiment, one of the pins 46, 47 is coupled to one end of a flexible shaft, whose other end is arranged at the spinning unit of the machine, e.g. in the region of a spindle bench of the ring spinning machine in the vicinity of a foot spindle bearing, this other end being adapted to be optionally connected to an external drive arranged, e.g., on the service robot.

[0045] The illustrated embodiments show an arrangement of the balloon limiter 4 designed for threading the yarn into the balloon limiter 4 from the front side, or, more precisely, from the front side of the ring bench 8. It is evident that the arrangement of the balloon limiter, the machine and the method according to the invention for handling the cop 10 within the limited space can be equally efficient also for threading the yarn from the left or right lateral side of the yarn balloon limiter 4, or from the left or right lateral side of the ring bench 8, in a plane inclined to the right or to the left with respect to the perpendicular plane towards the front side of the ring bench 8.

[0046] The invention is used at the spinning unit of a ring spinning machine during the process of yarn production, when it reliably limits the size of the yarn balloon by a divided limiting ring consisting of two halves of the ring 50 and 51, as well as during the service operations at the spinning unit after a yarn break or when spinning is started, when the invention allows handling the cop 10 within the limited space without conflict with other parts of the machine, as well as easy and simple yarn insertion into the functional limiting opening of the ring without complicated spatial manipulation with the yarn end.

Reference numbers

[0047]

0	Roving
1	Drafting device
2	Yarn twisting and winding device
3	Roving guide
30	Holder
31	Rear end
4	Balloon limiter
41	Static holder
42	Protrusions
43	Protrusions
44	Opening
45	Opening
46	Pin
460	Rear end
4600	End portion
47	Pin
470	Rear end
4700	End portion
48	Holder
49	Holder
5	Ring traveller
6	Flange
7	Ring
8	Ring bench
9	Rotating tube
10	Cop
50	Half ring
500	End

51	Half ring
510	End
52	Control arm
53	Control arm
55	Connecting rod
550	Connecting rod
56	Pin-Joint
57	Stop lever
58	Piston rod
59	Pneumatic cylinder
60	Hose
61	Transverse arm
611	Continuous groove
612	Transverse pin
613	Through hole
62	Tension spring
63	Pin
64	Connection member
70	Control lever
74	Housing
740	Shaft
75	Two-arm lever
751	First arm
752	Second arm
77	Rod
78	Collar
84	Surfaces
86	Leaf spring
9	Sliding arm
90	Groove
91	Slidable drive
910	Bowden
911	Cable wire

A	Feeding direction of roving 0
B	Moving of ring bench 8
C	Direction
D	Direction
S	Direction

Claims

1. A yarn balloon limiter (4) at a spinning unit of a ring spinning machine, comprising

- a holder (41);
- a pair of pins (46, 47) mounted horizontally in the holder (41), wherein longitudinal axes of the pins (46, 47) are parallel to each other;
- a half ring (50, 51) connected to each of the pins (46, 47);
- wherein the two half rings (50, 51) arranged opposite each other to form a ring in closed position; and
- wherein the pins (46, 47) are coupled to a rotational drive to pivote around the longitudinal axes in order to open and close the ring formed by the two half rings (50, 51).

2. The balloon limiter (4) according to claim 1, **characterized in that** each of the half rings (50, 51) is provided with extended end portions (500, 510) and in the closed position, the extended portions (500) of the first half ring (50) overlap the extended end portions (510) of the second half ring (51).

3. The balloon limiter (4) according to claim 1 or 2, **characterized in that** one of the half rings (50, 51) is mounted so that it rotates upwards and the other half ring is mounted so that it rotates downwards.

4. The balloon limiter (4) according to claim 1 to 3, **characterized in that** between the holder (41) and the half rings (50, 51) on each of the pins (46, 47) is arranged a transverse control arm (52, 53), wherein both the control arms (52, 53) are coupled to each other by a connecting rod (55), one of the rotatable pins (46, 47) being provided with a transverse stop lever (57), against which rests the protruding element of the rotational drive.

5. The balloon limiter (4) according to claim 4, **characterized in that** a retractable piston rod (58) of a pneumatic cylinder (59) leans against the transverse stop lever (57), the pneumatic cylinder (59) being connected to the holder (41) to activate and close and open the balloon limiter (4).

6. The balloon limiter (4) according to claim 4 or 5, **characterized in that** one of the rotatable pins (46, 47) is provided with a second transverse arm (61), which is connected to the first control arm (53) and is situated opposite the control arm (53), the free end of the second transverse arm (61) being coupled to the holder (41) by a tension spring (62).

7. The balloon limiter (4) according to claim 1 to 3, **characterized in that** a control arm (70) is mounted at the front end of one of the rotatable pins (46, 47), whereby this pin (46, 47) is further provided with a transverse control arm (53), which is by the first connecting rod (550) coupled to the first end (751) of a two-arm lever (75), which is arranged transversely on a shaft (740), which is mounted on the holder (41) rotatably about its longitudinal axis, which is parallel to the longitudinal axes of the rotatable pins (46, 47), whereby the two-arm lever (75) is by its other arm (752) and the rod (77) coupled to the transverse control arm (82) of the other of the pair of pins (46, 47).

8. The balloon limiter (4) according to claim 7, **characterized in that** on the holder (41) is arranged a positioning spring leaf (86), which is associated with a collar (78) on the shaft (740) with the two-arm lever (75), wherein the collar (78) is provided with a pair

of positioning surfaces (84) turned with respect to each other, on which the leaf spring (86) abuts in the working or threading position of the half rings (50, 51).

9. The balloon limiter (4) according to claim 1 to 3, **characterized in that** the rotatable pins (46, 47) are at their rear ends (460, 470) bent first towards each other and then in the opposite direction, being shaped like the letter "U", whereby the bent end portions (4600, 4700) of the two pins (46, 47) pass transversely through the longitudinal horizontal groove (90), which is situated parallel to the plane passing through the longitudinal axes of the two rotatable pins (46, 47) and which is arranged in the vertically sliding arm (9), which is reversibly slidably mounted in the holder (41) and which is coupled to a vertical reversible slidable drive (91).

10. The balloon limiter (4) according to claim 9, **characterized in that** the vertical reversible slidable drive (91) comprises a vertically situated bowden (910), which is by one of its ends mounted on the rigid part of the holder (41) and by its other end is adapted to be mounted on the rigid part of a holder (30) of a tiltable yarn guide (3), whereby a cable wire or string (911) passes through the bowden (910), the cable wire (911) being connected by one of its ends to the vertically sliding arm (9) and the longitudinal groove (90) and by its other end being adapted to be connected to the vertically movable part of the tiltable yarn guide (3).

11. The balloon limiter (4) according to claim 9 and 10, **characterized in that** both the half rings (50, 51) are mounted in such a manner that they can rotate up or down.

12. The balloon limiter (4) according to any of claims 1 to 10, **characterized in that** the half rings (50, 51) are formed by bent steel sheet or by a body made of technical ceramics.

13. The balloon limiter (4) according to any of claims 1 to 11, **characterized in that** the half rings (50, 51) are provided with an abrasion-resistant surface finish.

14. The balloon limiter (4) according to any of claims 1 to 12, **characterized in that** the half rings (50, 51) are mounted on the pins (46, 47) detachably.

15. The balloon limiter (4) according to claim 13, **characterized in that holders** (48, 49) are mounted on the pins (46, 47), in which the half rings (50, 51) are mounted detachably.

16. The balloon limiter (4) according to claim 14, **characterized in that** the holders (48, 49) are formed by molding plastic parts or plastic splatter, or they are made of a fiber composite or metal, or a combination of at least two materials.

17. The balloon limiter (4) according to any of claims 1 to 15, **characterized in that** one of the pins (46, 47) is coupled to one end of a flexible shaft, whose other end is arranged at a spinning unit of the ring spinning machine and is adapted to be optionally connected to an external drive.

18. A ring spinning machine comprising a row of spinning units arranged next to each other, wherein each spinning unit has a drafting device (1), a roving guide (3) and a yarn twisting and winding device (2), whereby at each spinning unit in the region between the roving guide (3) and the yarn twisting and winding device (2) is arranged the yarn balloon limiter (4) according to any of claims 1 to 16.

19. A method of threading yarn into the yarn balloon limiter (4) according to any of claims 1 to 16 during the resumption of yarn production or when replacing a cop (10) at a spinning unit of a ring spinning machine, in which the yarn end is handled in such a manner that it is guided successively into the working nodes of the spinning unit from the cop (10) to the roving drafting device (1) and during this handling operation the yarn is threaded into the balloon limiter (4),
characterized in that
before threading the yarn, the balloon limiter (4) opens due to the turning of the half rings (50, 51) about the horizontal axis from the vertical position, the yarn is guided to the space defined by the half rings; and
the half rings (50, 51) turn about the horizontal axis from its original horizontal to the vertical position back to the horizontal position, thereby closing the balloon limiter (4).

20. A method of handling a cop (10) moving to/out of the balloon limiter (4) according to any of claims 1 to 16 during the resumption of yarn production at a spinning unit of a ring spinning machine or during the replacement of the cop, in which the cop (10) is handled by being removed from or put on the spindle of the spinning unit below the roving drafting device (1) and during this manipulation the cop is handled in the space of the balloon limiter (4),
characterized in that
before the manipulation the balloon limiter (4) opens by turning the half rings (50, 51) about the horizontal axis from the originally horizontal position to vertical position, the cop (10) is removed/inserted through the space defined by the half rings (50, 51), and
the half rings (50, 51) turn about the horizontal axis from the vertical position back to the horizontal po-

sition and the balloon limiter (4) closes.

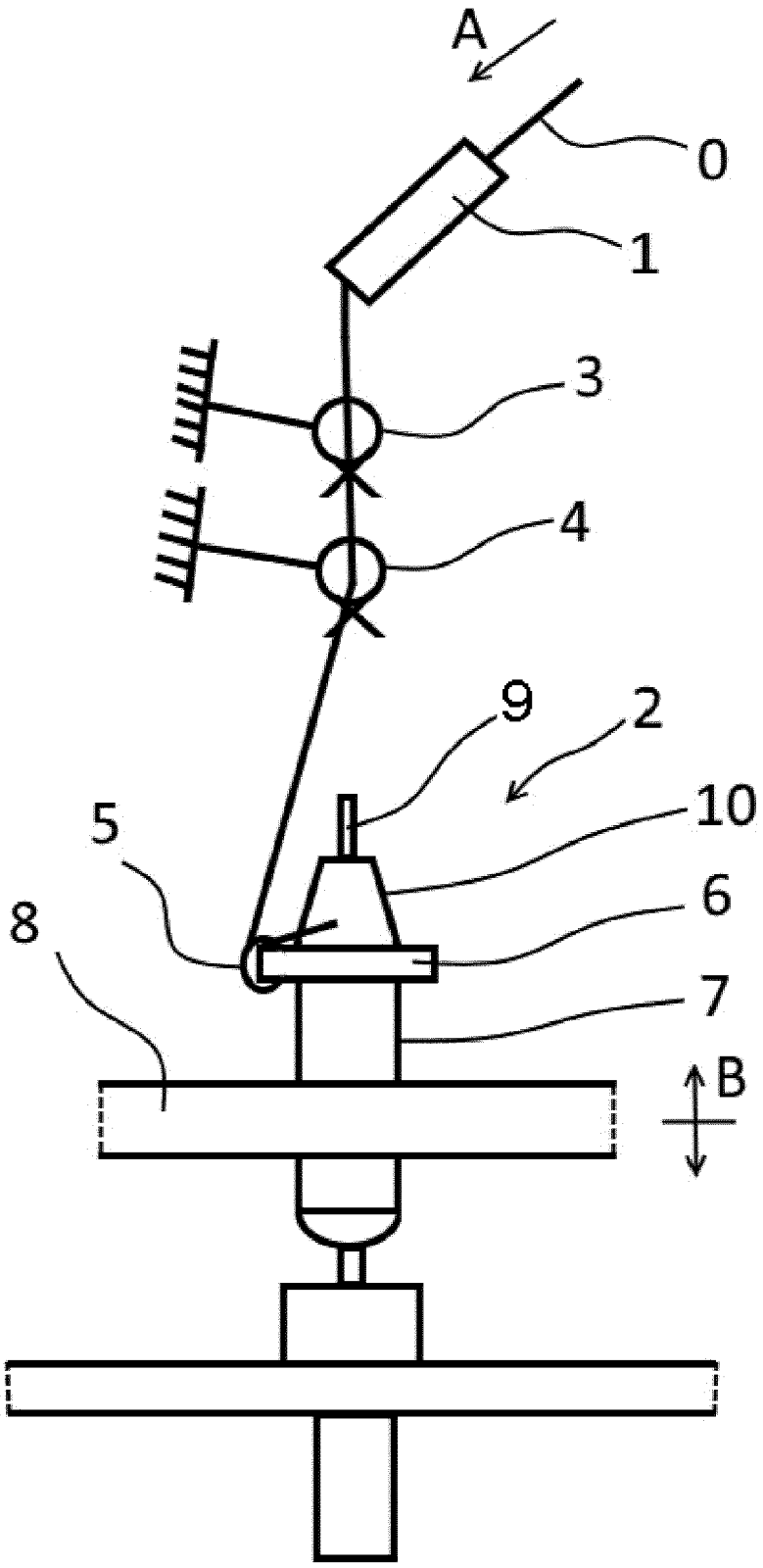
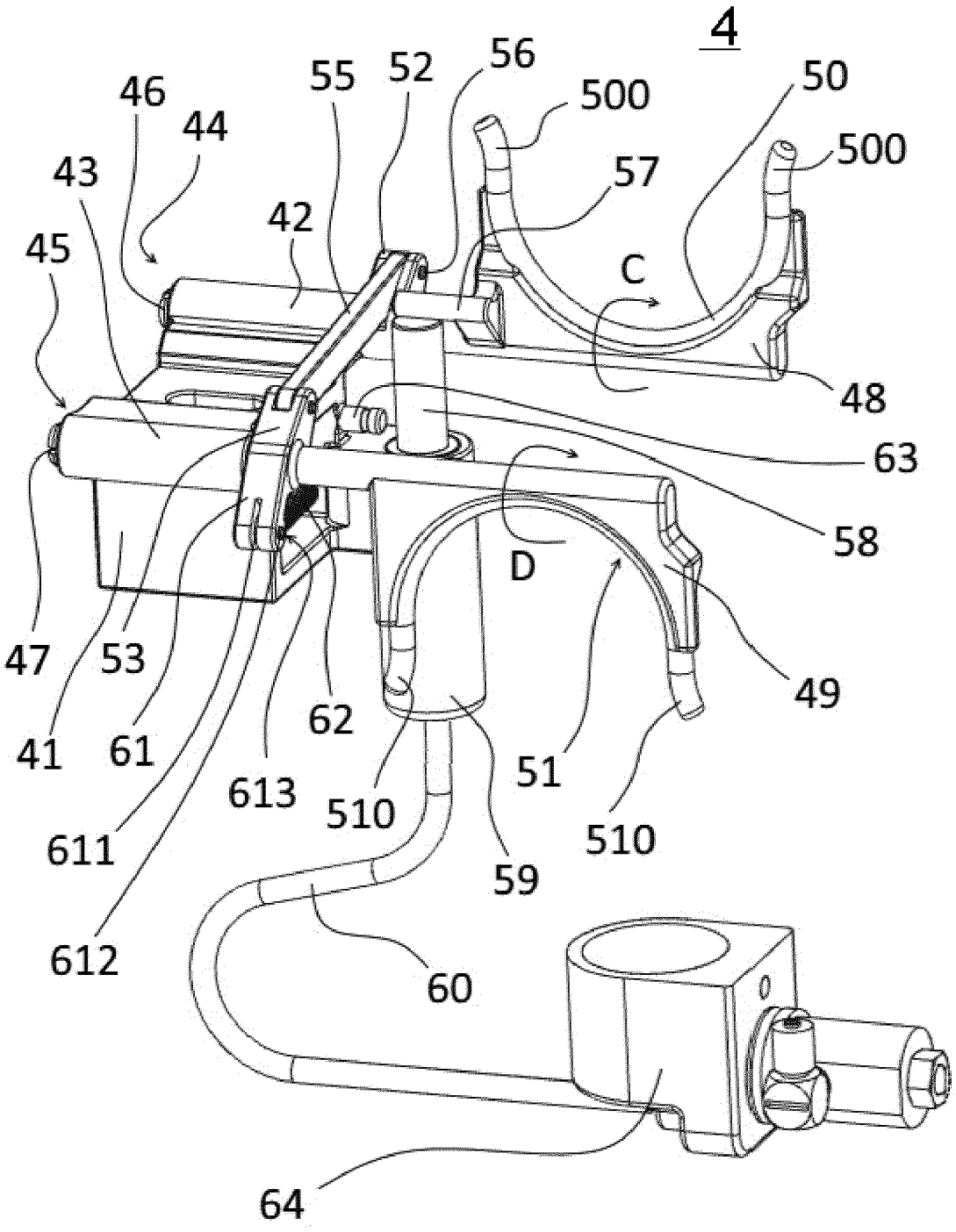


Fig. 1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44
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45
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500
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42
C
48
63
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611
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510
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51
510
60
64

Fig. 2a

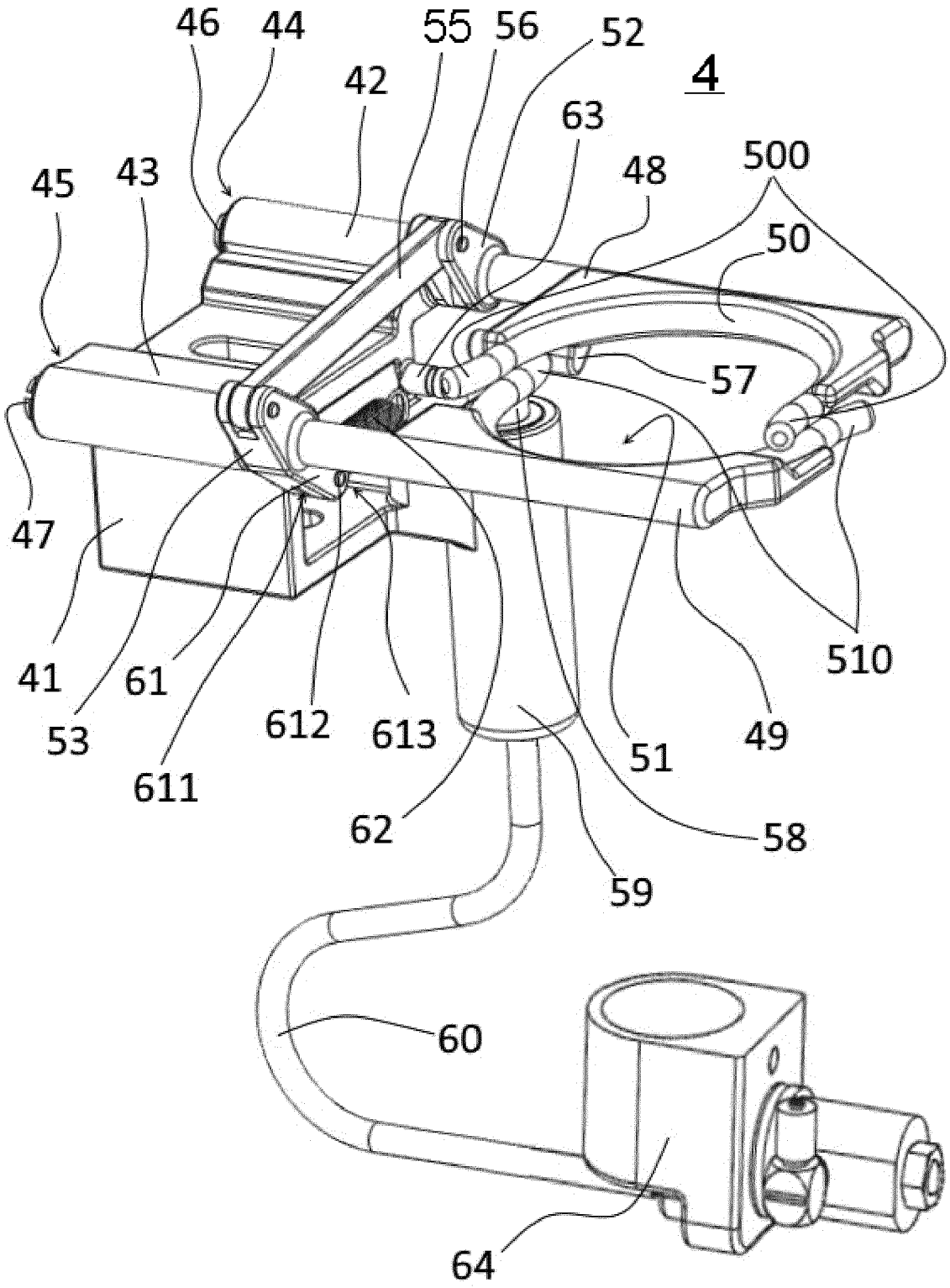
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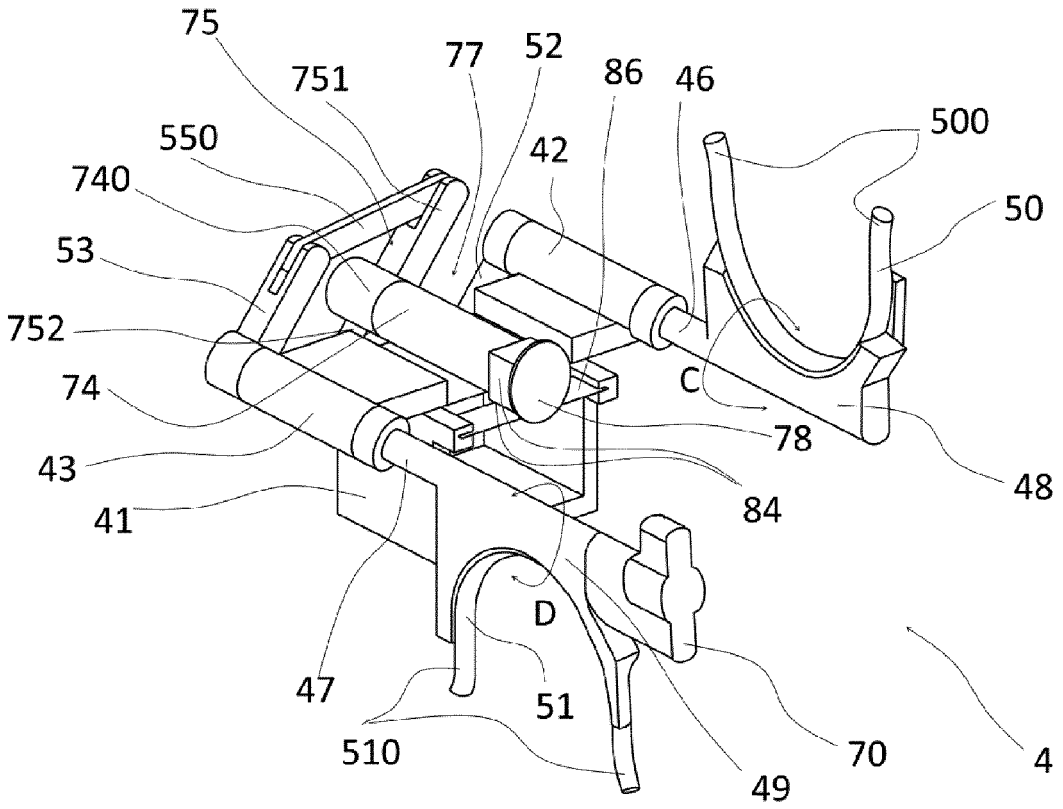
Fig. 2b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751
77
52
86
46
500
550
42
740
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752
C
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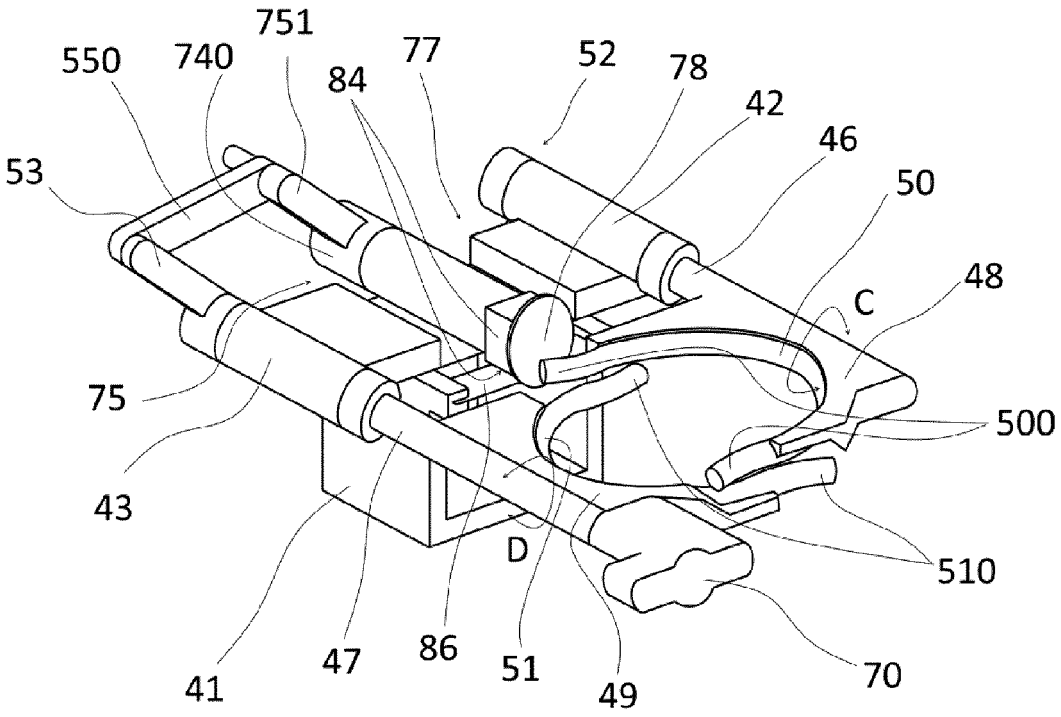
84
41
D
47
51
70
4
510
49

Fig. 3a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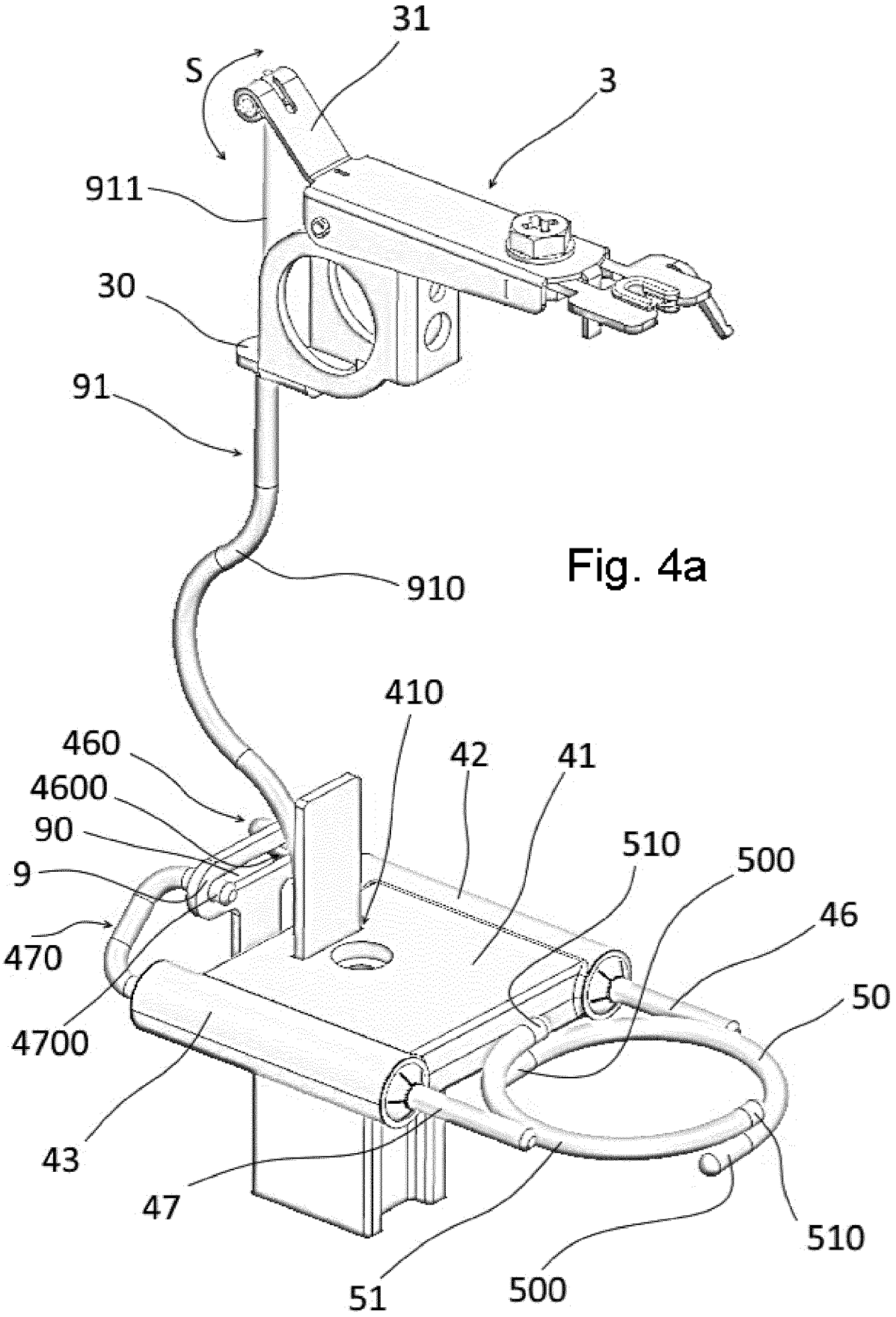
70

Fig. 3b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47
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51
500

Fig. 4a

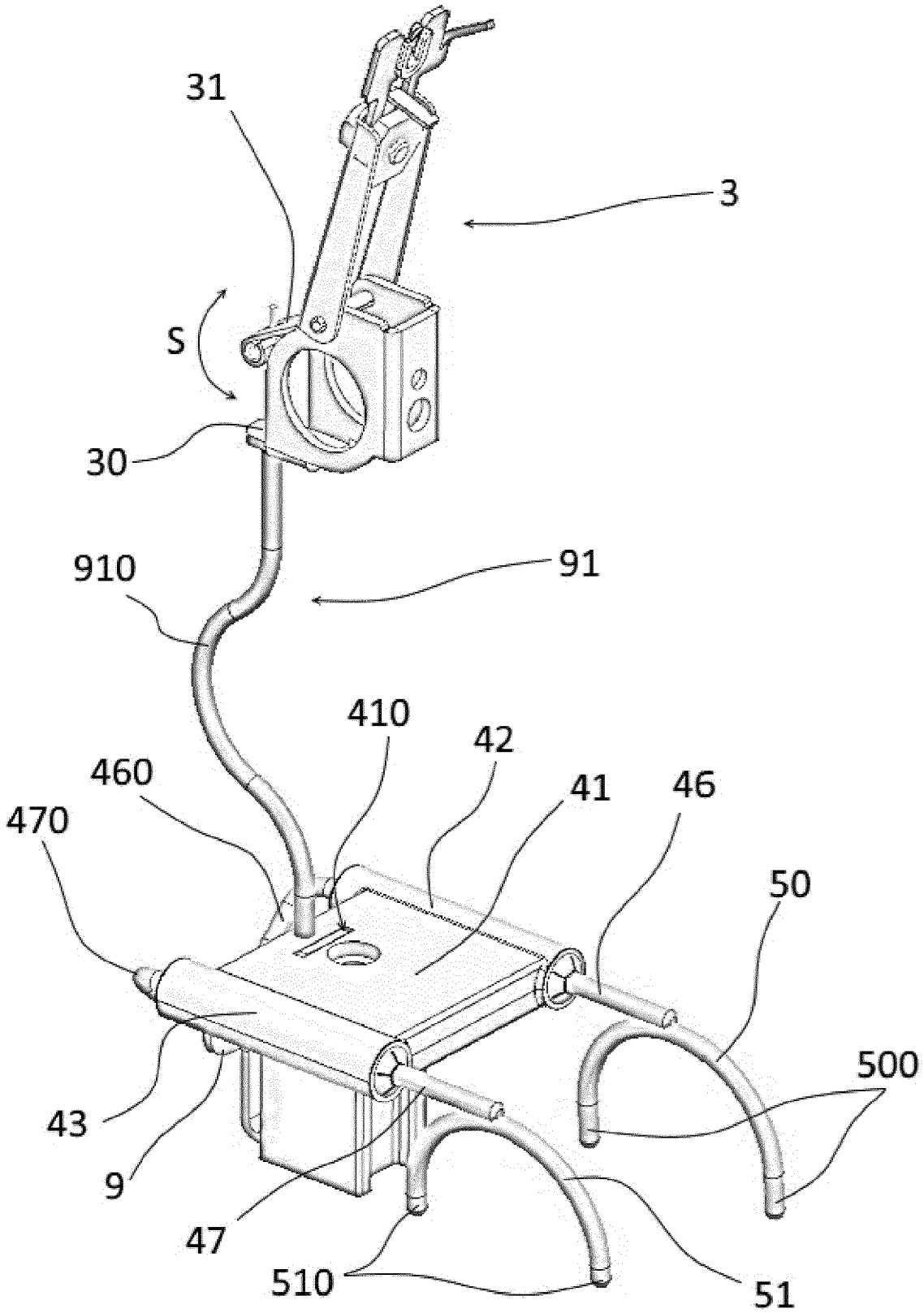

Fig. 4b

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 6894

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,P	WO 2019/048980 A1 (RIETER AG MASCHF [CH]) 14 March 2019 (2019-03-14) * page 5, line 11 - line 27 * * page 8, line 2 - line 3 * * figures 1-9 * * claim 10 * -----	1,2,11, 13,14, 18-20	INV. D01H1/42 D01H7/18 B65H57/22
A	GB 06193 A A.D. 1910 (RILEY ROBERT; ASHWORTH JAMES HENRY ET AL.) 22 December 1910 (1910-12-22) * abstract; figure 5 * -----	17	

TECHNICAL FIELDS SEARCHED (IPC)

D01H
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 October 2019	Humbert, Thomas

CATEGORY OF CITED DOCUMENTS

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16-10-2019

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WO 2019048980 A1	14-03-2019	CH 714126 A1	15-03-2019
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